

Overview of Advanced Foods and Materials Network (AFMNet) and Nanoscale Projects funded by the AFMNet

USDA/CSREES-AFMNet Joint Nanoscale Science, Engineering & Technology Grantees' Meeting

Rickey Y. Yada
Scientific Director
rickey.yada@afmnet.ca



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Networks of Centres of Excellence

(NCE) Program Mission (1989):

“To mobilize Canada’s research talent in the academic, private and public sectors and apply it to developing the economy and improving the quality of life of Canadians.”

NCE Government Sponsors:

Federal Research Granting Councils:

Canadian Institutes of Health Research (CIHR)

Natural Sciences and Engineering Research Council (NSERC)

Social Sciences and Humanities Research Council (SSHRC)

Industry Canada



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NCEs: Canada-wide networks linking universities, public and private sectors.

21 NCEs in 4 broad areas:

Health and Biotechnology

e.g., Food (AFMNet), Arthritis (CAN), PrioNet

Information and Communication Technology

e.g., Robotics (IRIS)

Engineering and Manufacturing

e.g., Automobiles (Auto21), Smart structures (ISIS)

Natural Resources and Infrastructure

e.g., Clean water (CWN)



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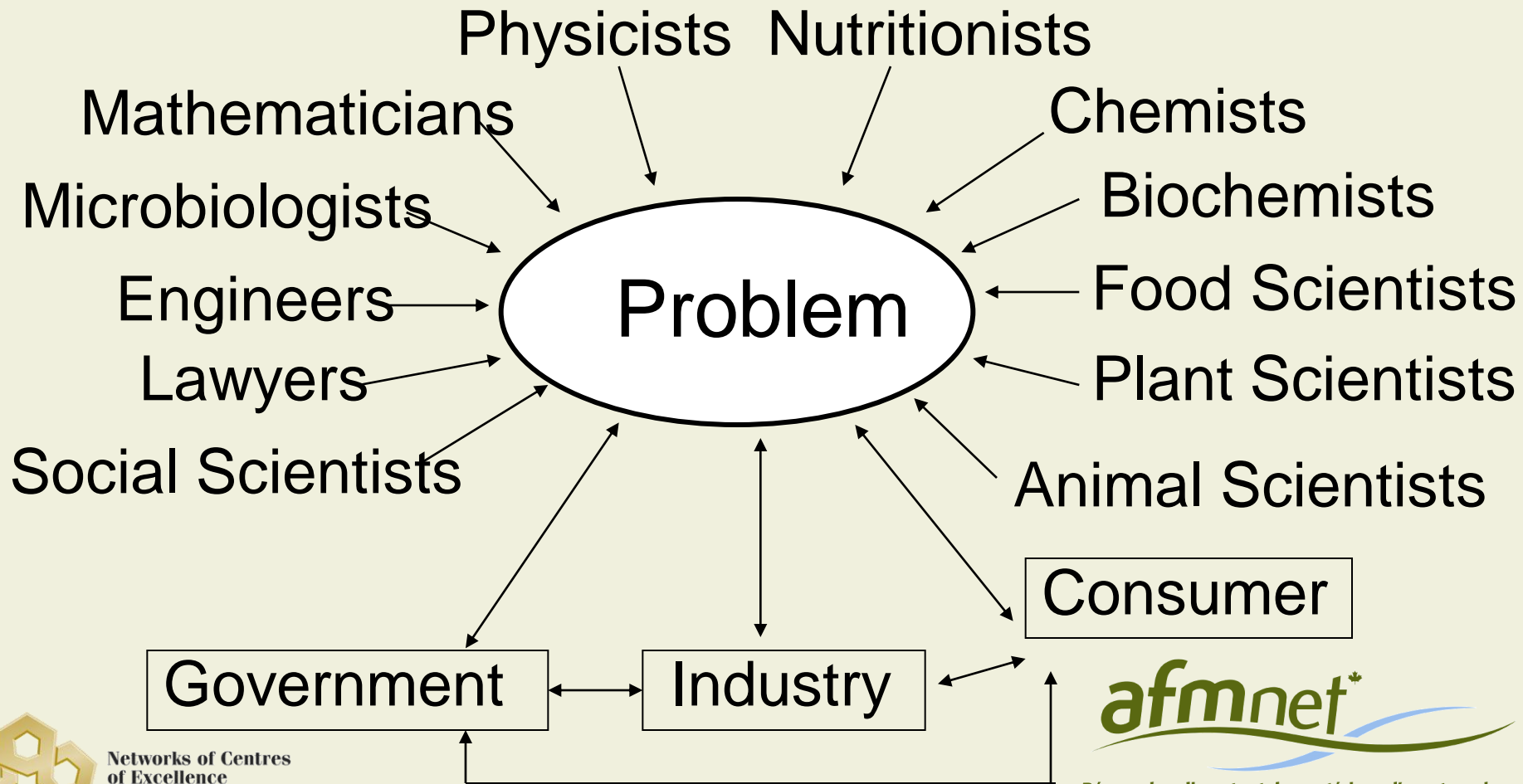
AFMNet NCE:

- Funded for a maximum of two 7-year cycles
- Started with 49 Projects in 3 Themes; went to 20 projects; 2009 - 12 projects and other projects
- 75 Professors in 24 Universities
 - Eminent researchers: Canada Research Chairs, Industrial, University, etc - 26

AFMNet NCE:

- ca.100-150 HQP (Students, PDF's, Res. Associates)
 - Recruitment gap - engaging non-traditional disciplines (outside of food science/technology)
- ca. 20 Companies
- ca. \$5.5 Million per year from NCE
 - industrial partners cash and in-kind (\$3.5M)
 - individual research grants
 - Infrastructure programs

AFMNet Research



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Research Program

3 Interrelated Themes: *Research continuum from fundamental to applied; “Atom to Application”*

2005-2009

Theme I: Science and Engineering of Foods and Bio-materials

- [1] Bio-surfaces.
- [2] Bio-structures & Bio-products.

Theme II: Food Bioactives and Health Outcomes

- [1] Extraction and Identification.
- [2] Mechanism and Efficacy.

Theme III: Regulation, Policy and Consumer Health

- [1] Consumer & Citizen Perception and Acceptance.
- [2] Regulation and Policy.
- [3] Risk Assessment and Management.



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Science and Engineering of Foods and Bio-materials

1	D. Rousseau	Ryerson	Biopolymer-based platforms for controlled release applications in foods and biomaterials
2	J. Dutcher	Guelph	Bacteria, Biofilms and Foods: Structure, Growth and Nanotechnology Applications
3	J. Lipowski	Guelph	Protein and Peptide Self-Assembly: Food-Derived Materials and Interactions with Nanostructured Surfaces
4	T. Gill	Dalhousie	Bacterial Porin Proteins: Their Importance in Uptake and Resistance to Cationic Antimicrobial Peptides
5	A. Hitchcock	McMaster	Resistance and control of biofilms on food and food processing surfaces
6	N. Low, M. Nickerson and D. Korber	Saskatchewan	Production, Characterization and Functionality of Plant-extracted Oligosaccharides Towards Enhancing the Health-promoting Properties of Encapsulated Probiotics
7	R. Hancock	UBC	Engineering new microbial agents for food safety
8	R. Aluko	Manitoba	Structure-function properties of novel bioactive peptides
9	B. Moffatt	Waterloo	Characterization of Plant-Derived Proteins and Carbohydrates and Their Use to Improve Frozen Food Quality



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Food Bioactives and Health Outcomes

10	A. El-Soheemy	Toronto	Nutrigenomics and Biomarkers of Chronic Disease	
11	J. Friel	Manitoba	Bioactive Compounds in Human Milk	
12	Y. Mine	Guelph	Nutrigenomic and proteomic approaches for the study of functional peptides and amino acids to improve gut health	
13	A. Marette	Laval	The beneficial effects of fish nutrients on the obesity-linked metabolic syndrome and cardiovascular risk profile. An integrative genomic and metabolic phenotyping project.	
14	P. Jones	Manitoba	Conjugated Linoleic Acid as a Nutraceutical for Health Promotion in Humans	
15	B. Selinger	Lethbridge	Manipulation of intestinal bacterial populations; an investigation on the impact of dietary fibre and prebiotics	



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Regulation, Policy and Consumer Health

16	T. Henson	Guelph	Understanding Consumer Acceptance of Functional Foods and Nutraceuticals	
17	H. Boon	Toronto	Natural Health Product Regulations: Perceptions and Impact	
18	D. Castle and T. Caulfield	Ottawa and Alberta	Social Issues in Nutritional Genomics: The Design of Appropriate Regulatory Systems and Issues of Public Representations and Understanding	
19	C. Forsberg and M. Fortin	Guelph and McGill	Omics for Novel Plant and Animal Food Product Assessment and Risk Identification	
20	C. Brunk and S. Hartley	Victoria	Factors Accounting for Expert and Non-Expert Positions on the Ethical Issues in Animal Biotechnology and the Implications for Public Policy	



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Discovery Projects - 2009

Do apolipoprotein E polymorphisms influence risk of cognitive decline by modulating omega-3 fatty acid metabolism?	Melanie Plourde Stephen Cunnane
***Engineering the oil binding capacity and rheological properties of nanocrystalline fat networks structured using high shear fields under non-isothermal conditions	Gianfranco Mazzanti Alejandro Marangoni
Examining the impact of diet and the intestinal microbiome on gut health and general well-being	Brent Selinger Martin Kalmokoff
***Nutrigenomic studies on the effectiveness of stabilizing reduced folates using nano-encapsulation technologies	David Kitts



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Discovery Projects - 2009

*** Bacteria Biofilms and Foods: Nanotechnology-based strategies for the detection, characterization and remediation of bacterial contamination of foods and food processing surfaces	John Dutcher
***Biopolymer based controlled release systems for biomedical applications	Wankei Wan
Creation of a new fish-peptide/n-3 PUFA-based functional food for the treatment of obesity and type 2 diabetes moving towards nutrigenomics-based personalized nutritional interventions	Andre Marette
Dietary peptide- and amino acid-based interventions to improve human gut health and immunity	Yoshinori Mine

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Discovery Projects - 2009

***Salt, science and society - a collaborative approach to salt reduction in processed foods	Derick Rousseau
The AFMNet Consumer Monitor: Tracking consumer attitudes towards new products for health and wellbeing in Canada	Spencer Henson
The traceability and authenticity of foods from analytical and consumer perspectives	Nicholas Low
Toronto nutrigenomics and health study	Ahmed El-Sohemy

Engineering the oil binding capacity and rheological properties of nanocrystalline fat networks structured using high shear fields under nonisothermal conditions

- the rheological properties which are critical for fat functionality (roll-in shortenings in particular) in laminated bakery products.
- the understanding of the structural factors responsible for oil binding in fat crystal networks
- also create models which explain the functional dependence of structural factors in fat crystal networks on shear rate, degree of undercooling and the combination of the two.

Salt, science and society - a collaborative approach to salt reduction in processed foods

- manipulating the perception of saltiness through salt delivery via micron/sub-micron biomolecular carriers, and their targeted distribution within foods
- establishing the links between taste perception and individual genetic profiles, based upon ethnic origin and gender – nutrigenomics approach



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Biopolymer based controlled release systems for biomedical applications

- preparation of electrospun nanofibers with/without the incorporation of growth factors.
- kinetics and modeling of the controlled release process from growth factor loaded nanofibers.
- preparation of injectable hydrogels (glycol chitosan, hyaluronan/methyl cellulose) for cell delivery: test hydrogels for rheological properties, cell viability, differentiation, proliferation using neural stem/progenitor cells (NSPCs), adipose stem cells (ASCs), radial artery cells (RACs)
- Incorporation of nanofibers into injectable hydrogels to study physical/mechanical properties of the scaffold formed and the nanofiber orientation
- Incorporation of nanofibers and cells (NSPCs, ASCs, RACs) into the injectable hydrogels to study cell orientation, viability, differentiation, proliferation in vitro



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Commercialization – R2B Team of Experts

- Venture Capitalist
- Scientist turned Entrepreneur
- IP & Patent Lawyer
- Financial Expert
- University-Industry Liaison Office
- Business Development Director



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Strategic Transition & Application of Research program (STAR)

- Exploit research results and developments (IP) that promise to advance knowledge and technology transfer in emerging areas related to foods and bio-materials research by supporting Proof of Principle and Knowledge Mobilization projects which are of benefit and relevance to the social and economic health of Canada
- Funding up to \$150,000/project (1 year) is available

Targeted RFP – 2008/09

- First call for projects specific to Authentication/Traceability
 - DNA Bar Code
- Funding up to \$150,000/1 project (1 year)
- Minimum industrial match 20% expected
- More RFPs TBA in response to emerging opportunities



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Business model

- Combination of “Blue Sky” and strategic research (consultation)
- Engagement of public/policy early
- Quarterly reporting system
- Go No Go decisions early
 - If we fail let’s fail early
- Shared risk – mitigate risk
- Sustainability strategy (exit strategy – government \$)

Governance

- Network Researchers
- Theme Leaders
- Research Management Committee
- International Scientific Advisory Board
- Administrative Centre
- Board of Directors



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Communications

- Director of Communications
- Student Writers Program
 - ADVANCE magazine (wide distribution, awards)
- Working with other groups (e.g., dietitians, family physicians)

Canadian Network of Technology Centres for Food and Bio-Products

- Consortium of various players
 - Associations, e.g., B.C. Food Processors Assoc.
 - Organizations, e.g., Western Canadian Functional Food & Natural Health Product Network
 - Information services, e.g., University of British Columbia Food Information Service
 - Processing plant facilities, e.g., Guelph Food Technology Centre



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International Food Research Collaboration

- Australia
 - National Centre of Excellence in Functional Foods
- New Zealand
 - Nutrigenomics New Zealand
 - Riddet Centre (Massey, Otago and Auckland)
- Greece
 - Laboratory of Agribusiness Management - Agricultural University of Athens
- NUGO, EuroFIR, MoniQA (EU Framework)
- Food and Nutrition Delta (Netherlands)



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Importance of International Industrial/Network Partners

- Industry
 - Taiyo Kagaku Co. Ltd
 - General Mills
 - Kraft
 - Coca Cola China
 - Food and Nutrition Delta
- Other Agencies, e.g., USDA CSREES

Value Proposition: Support of research, Global intelligence (who's doing what - synergies), Strategic directions (target & redundancies)



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Strategic Directions

- Food and Health
 - Nutrigenomics
 - Gut Health (IBD, Crohn's disease)
 - Pre-, probiotic
 - Predictive modeling
- Nanoscale science and technology
- Traceability/authentication
- Policy, regulation and attitude



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Opportunities

- Exchanges – scientists, HQP
- Joint research projects
- Joint workshops
- Policy development, e.g., nanotechnology, sodium

Some Food for Thought

Thank you

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